

POLITECNICO
DI TORINO

Market research

Household refrigerators

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Understanding the customers' perception about the product,
investigating customers' behaviour of use and needs



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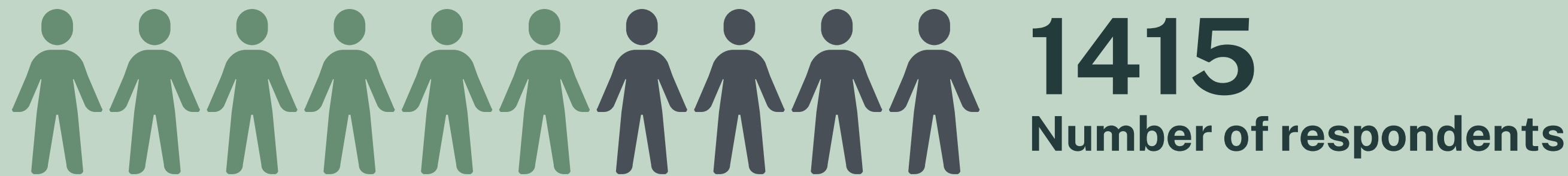
Preparation step for the market research: tertiary and secondary needs collection

- ➔ **STEP 1. Creation of the list of the tertiary needs**
Interviews + personal experience of the team (accession of the characteristics of the fridge at home: what is missing or what can be done better)
- ➔ **STEP 2. Secondary needs formulation**
Results analysis, brainstorming for transition from tertiary to secondary needs for the further research with the questionnaire
- ➔ **STEP 3. Creation of the questionnaire**
On a basis of the uncovered secondary needs

Transition of the tertiary needs to secondary

Tertiary needs	Secondary needs
a fridge that consumes less energy, there should be a correlation between the size of the fridge and the quantity of energy consumed	Energy consumption
it should have well organised space, any place inside the shelf should have a defined goal	Space
a fridge that look good, attractive geometry, nice colour, intuitive design	Aesthetics
at least 1 door and no more than 5 doors	Number of doors
a press bouton to manage the temperature	Adjustable temperature
enough compartments both in the fridge and the freezer, the number of shelves should match the size of the refrigerator: the more the the larger	Shelving units

Questionnaire description



Section	Goal	
Demographics & Lifestyle	General customer portrait	
Dietary Habits	Tend to keep specific products	
Refrigerator Usage	General description of the current fridge	
Future Preferences	Aspects valuable for a choice in the future	
Willingness to Pay	Perception of price for a fridge of average size	The aim is to formulate the primary needs of customers and to estimate potential ideal price to provide valuable insights to refrigerator manufacturers
Household Income Details	Economical view on customers	

Performed checks for the dataset



1. "How many people live together with you? (including you)"

In order to not delete too many parameters and, thinking that many have not read "including you" we decided to convert each parameter equal to 0 in 1.

→ `IF(DATASET!C2=0;1;DATASET!C2)`

2. "What is the dimension of your refrigerator (including any freezer)?"

Whereas it would be impossible that, in a house where more than 4 people live, there would be a small refrigerator, we decided to set to 0 all the cells that did not respect this logical sense.

→ `IF(AND(DATASET!H2=1;DATASET!C2>4);0;DATASET!H2)`

3. Check on all needs

In order to be as thorough as possible, we did a check on all needs checking that no one had answered randomly (e.g. all 1 or all 5). To do this, we decided that if the average of all cells in the row were less than 1.5 or greater than 4.5, the cells would be set to 0.

→ `IF(OR(AVERAGE(DATASET!$AK2:$BD2)<1,5;AVERAGE(DATASET!$AK2:$BD2)>4,5);0;DATASET!AK2)`

4. Indicate a price that you think is excessively cheap (to the point where you doubt the quality) for an average size refrigerator

We adjusted the pricing to maintain a reasonable range, setting any values under 40 and over 2500 to 0. We also corrected inconsistencies in price ranges, specifically null cells showing cheaper prices as higher than more expensive ones.

-> `IF(OR(DATASET!BE2>DATASET!BF2;DATASET!BF2>DATASET!BG2;DATASET!BE2<80;DATASET!BE2>2500);0;DATASET!BE2)`

Performed checks for the dataset



5. Indicate a price you think is good to you (such that you consider it "a good deal") for an average size refrigerator

Considering the ranges set previously and after checking that the price entered was greater than the previous but less than the most expensive, we set to 0 all values that were less or equal than 100 or greater or equal than 7000.

→ `IF(OR(DATASET!BF2<=DATASET!BE2;DATASET!BF2>=DATASET!BG2;DATASET!BF2<100;DATASET!BF2>7000);0;DATASET!BF2)`

6. Indicate a price you think is quite expensive for a refrigerator

After checking the increase in values, we checked which was the most expensive fridge on the market; for this reason we set to 0 values less than 200 or more than 9000, included.

→ `IF(OR(DATASET!BG2<=DATASET!BF2;DATASET!BG2<=DATASET!BE2;DATASET!BG2<200;DATASET!BG2>9000);0;DATASET!BG2)`

7. Indicate a price you think is overpriced for a refrigerator

As last test, we verified that the price indicated as "overpriced" was higher than the "quite expensive" one but less than 10000 (price higher than a commercial fridge)

→ `IF(DATASET!BH2<DATASET!BG2;0;IF(DATASET!BH2>10000;0;DATASET!BH2))`

Respondents profile

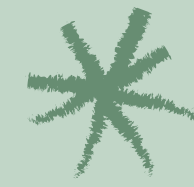


Age



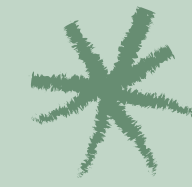
The majority (58%) are aged between 18-30. Less than 1% are under 18 or over 70, 25% of the individuals fall in the 51-70 age group.

Occupation



Most of the respondents are workers (41.8%) and students (29.5%). Only a few are jobless (0.8%) or retired (3.3%).

Diet



The majority (67%) do not follow a specific diet. A significant portion (24%) have dietary intolerances.

Number of people living in the house



More than three people live in most homes (62%). Two-people homes account for 23%.

City



Respondents are fairly evenly distributed among small villages (25%), small towns (25%), and large cities (33%). Fewest live in medium-sized cities (17%).

Current Refrigerators description

Fridges age



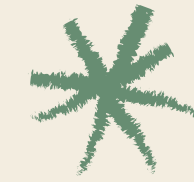
The most common refrigerator age group is 5-10 years (32.7%). Refrigerators aged 3-5 years follow next at 29.7%. The least common age group is less than 2 years (16.0%).

Dimension of fridges

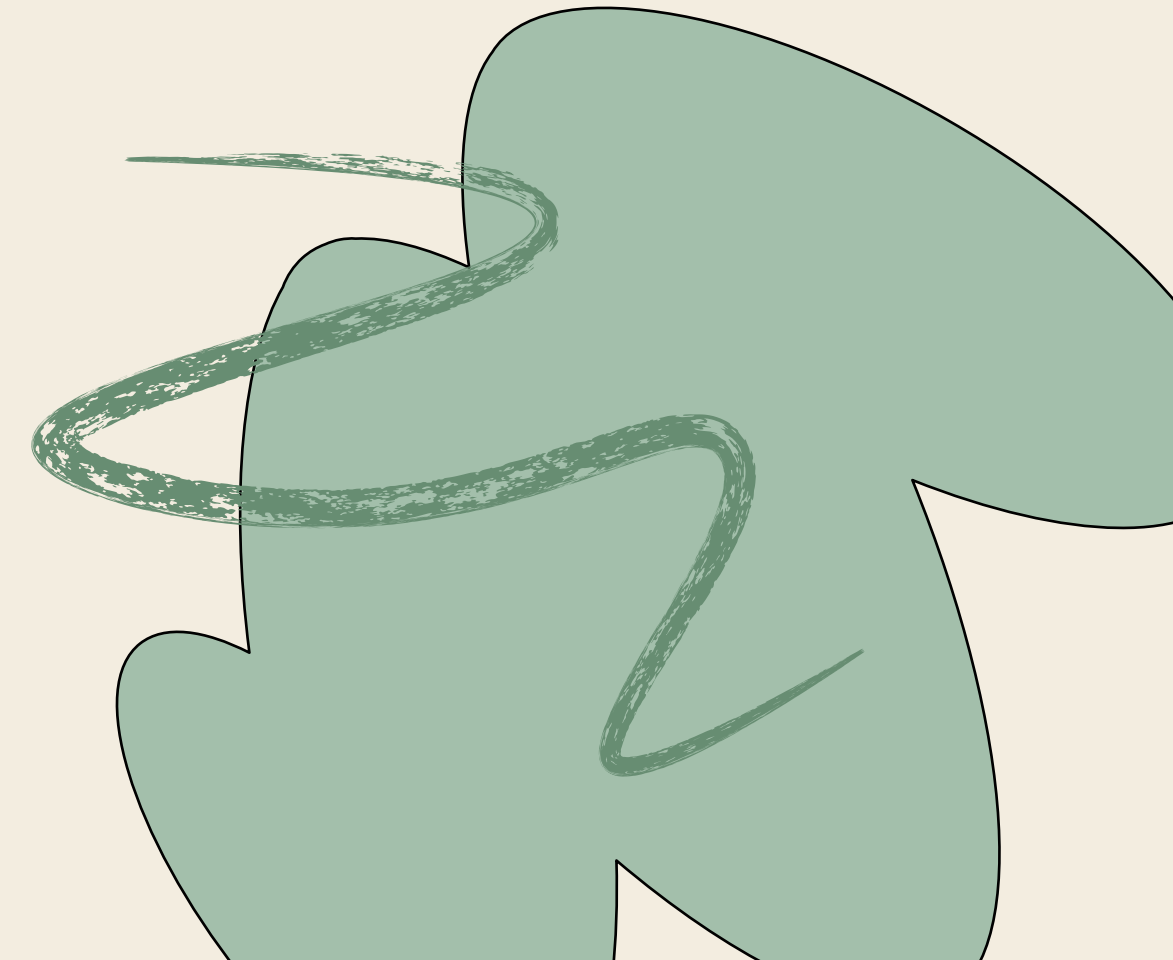


Most fridges are of medium size (49%). Large fridges are also quite common (36)%. Very large fridges (10.0%) and small fridges (5.0%) are less common.

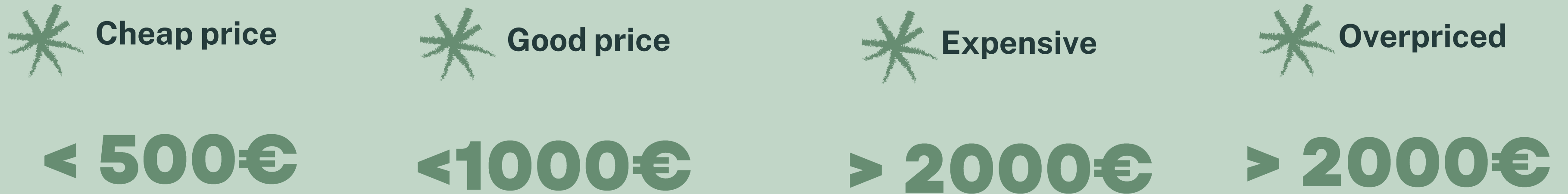
Price of fridges



Almost all fridges are priced under \$500 (98%). Very few fridges cost over \$1000 (0.1%).



Customer's perception of fridge prices



* According to 98,6% of customers

* According to 98,9% of customers

* According to 97,4% of customers

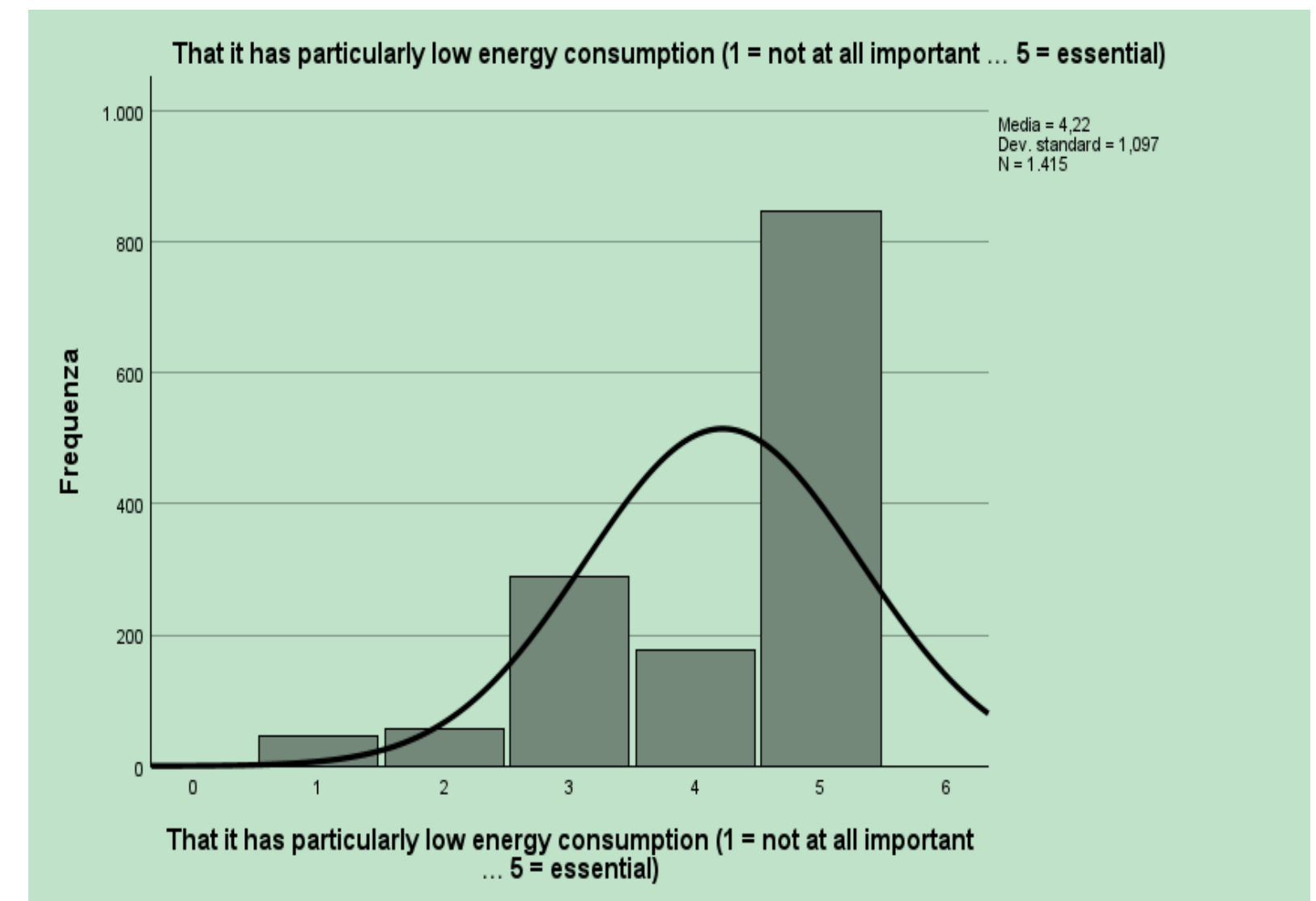
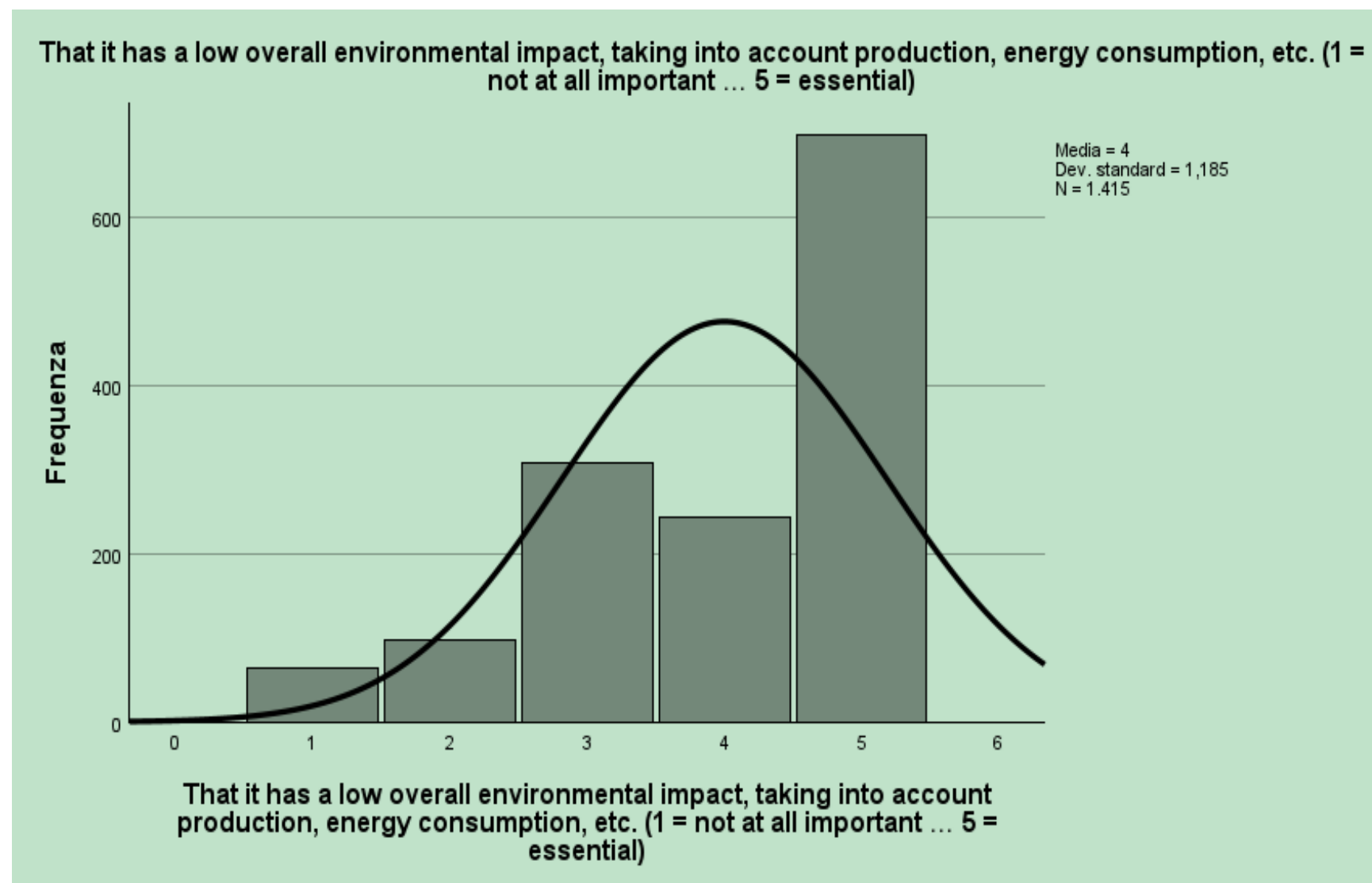
* According to 99% of customers



A general trend among respondents: they perceive a price under \$1000 as cheap or good, and anything over \$2000 as expensive or overpriced

Factor Analysis: Preparation

After having computed a descriptive statistics were analyzed the graphs and frequency tables of each variable and, since both Low Environmental Impact and Low Energy Consumption both had a distribution really biased toward the 5 (high importance), and since they are somehow connected to each other, it was decided that both those features are essential requirements for a fridge



Factor Analysis: First Iteration

In our initial attempt at factor analysis, we retained the variables of Low Environmental Impact and Low Energy Consumption

	% of Variance	Cumulative %
Variable 1	42.043	42.043
Variable 2	11.499	53.542
Variable 3	6.069	59.61
Variable 4	4,917	64,528
...	...	...

This produced highly satisfactory results, with all values on the Anti-Image Matrix exceeding 0.85, a KMO test result surpassing 0.932, and a substantial level of variance. This suggests that our model is already well-equipped to ascertain the primary needs

	Result
KMO	0.932
Appros Chi-square	15960.677
gl	190
Sign	<0.01



Despite these positive outcomes, the correlation matrix identifies a potential area of concern - the **Brand variable**. This feature exhibits several correlations below 0.3, a figure typically indicative of unsatisfactory results. However, we kept it within the system for the time being



Factor Analysis: Second Iteration

We ran again the factor analysis, this time without considering Low Environmental Impact and Low Energy Consumption, but we obtained a slight decrease both in variance and KMO, so it might not be a good idea removing them

	% of Variance	Cumulative %
Variable 1	41.939	41.939
Variable 2	10.854	52.793
Variable 3	6.634	59.427
Variable 4	5.418	69.845
...	...	...

	Result
KMO	0.921
Appros Chi-square	13440.704
gl	153
Sign	<0.01



Factor Analysis: Third Iteration

We ran again the analysis, but this time removing Brand, due to consideration we made previously and we obtained a KMO test of 0,930 and a variance of 61,518, meaning our system has improved

	% of Variance	Cumulative %
Variable 1	43.265	43.265
Variable 2	11.347	54.611
Variable 3	6.906	61.518
Variable 4	5.681	67.199
...	...	...

	Result
KMO	0.930
Appros Chi-square	16840.704
gl	138
Sign	<0.01



Factor Analysis: Fourth Iteration

We carried out a fourth iteration, this time setting the eigenvalues to 2 and excluding Brand. However, this produced subpar results compared to prior iterations. As a result, we decided to uphold the third iteration as the optimal one.

	% of Variance	Cumulative %
Variable 1	41.939	41.939
Variable 2	10.845	52.793
Variable 3	6.634	59.427
Variable 4	5.418	64.845
...	...	...

The result: 19 secondary needs and 3 variables.

The variable describe 65% of the dataset, what is a decent result



List of primary needs resulted by the factor analysis



1. Smart Functionalities & Maintenance

Attributes related to practical use, maintenance, and smart technology-enabled features of the fridge

Quiet, Different Temperatures, Easy to Wash, Odor Proof, Antibacterial Functionality, Incorrect Use Alert, Malfunctions Alert, Low Environmental Impact, Low Energy Consumption



2. Digital Integration & User Interaction

Features that enhance the user's digital interaction with the fridge

Inside View, Consume Advice, Connective, Remote Control, Inside Scale



3. Personalization & Accessibility

Encompasses features that make the fridge easy to customize, organize and use

Easily Movable, Well Designed Lighting, Product Placement Suggestion, Configurable Spaces, Aesthetically Customizable

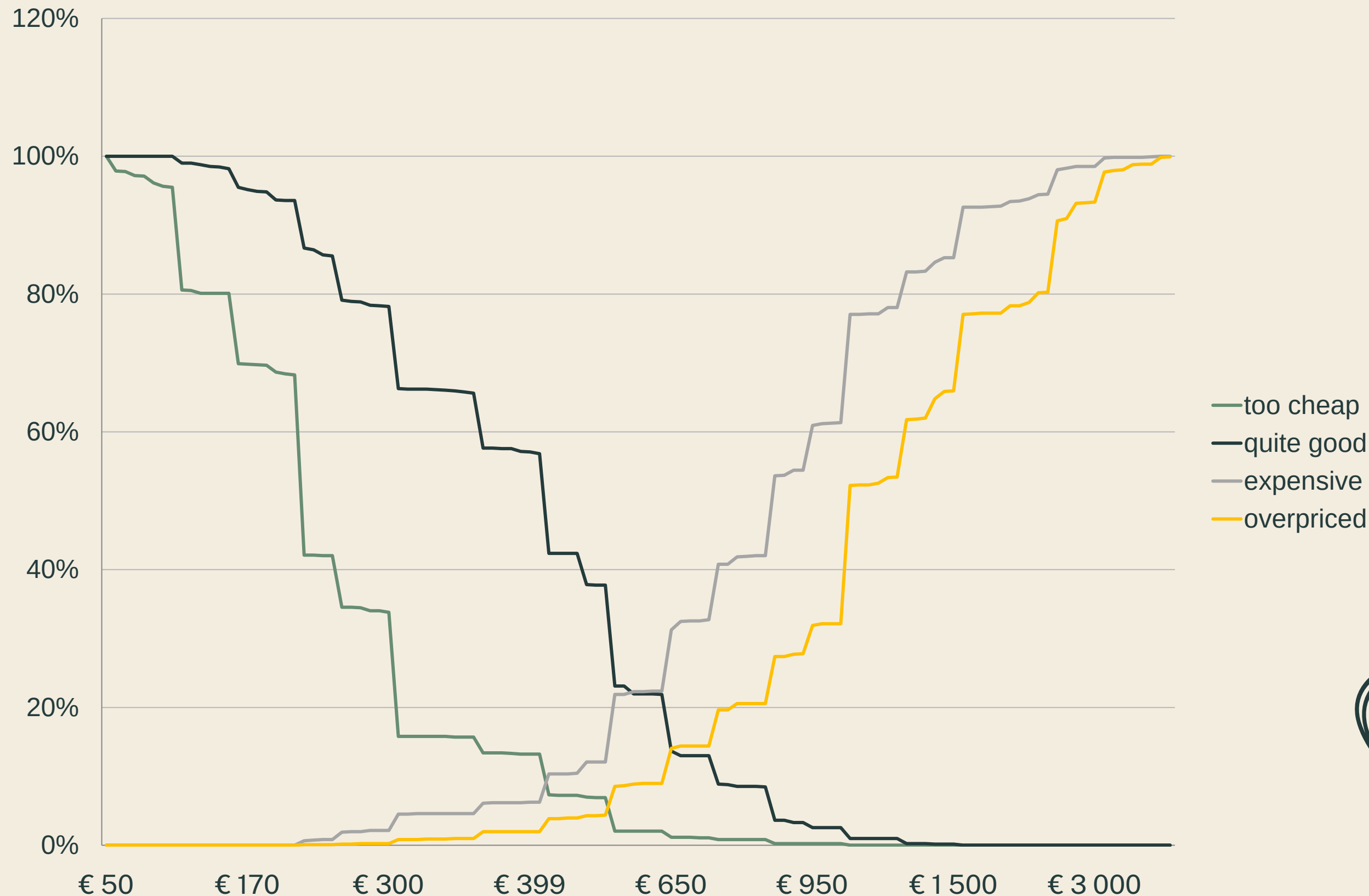


4. Brand

Well-known by the customer and reliable



Ideal price detection (Van Westendorp graph)



According to price sensitivity approach, were depicted 4 graphs, respectively: too cheap, quite good, expensive and overpriced

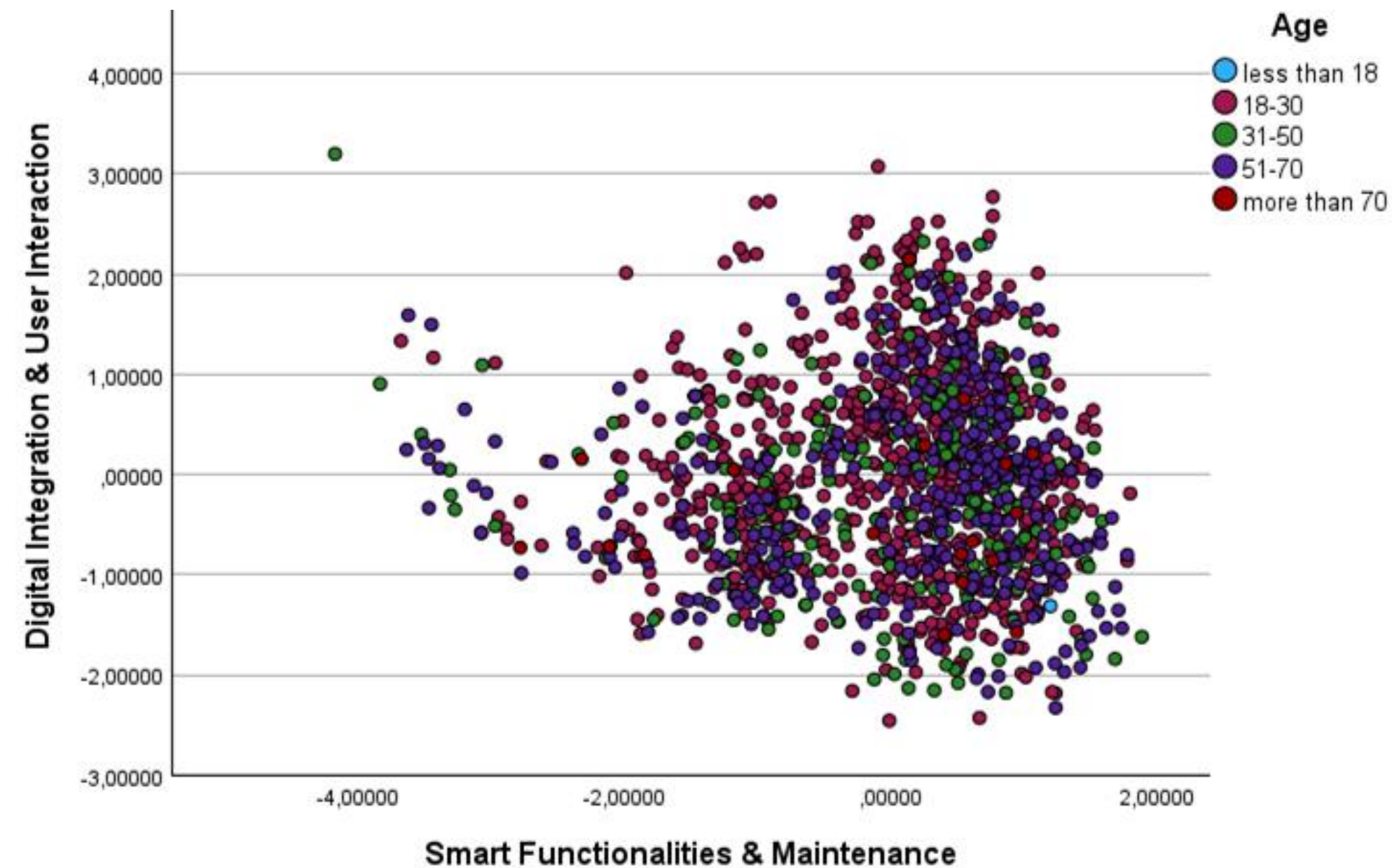
- €400,00 is the point of **marginal cheapness**
- €680,00 is the point of **marginal expensiveness**
- €570,00 is the **indifference point**
- €500,00 is the **optimal price**

Customers will be willing to buy fridges which costs range from **€400 to €680**

THE IDEAL PRICE

€500

Respondents' positions in the perceptual space

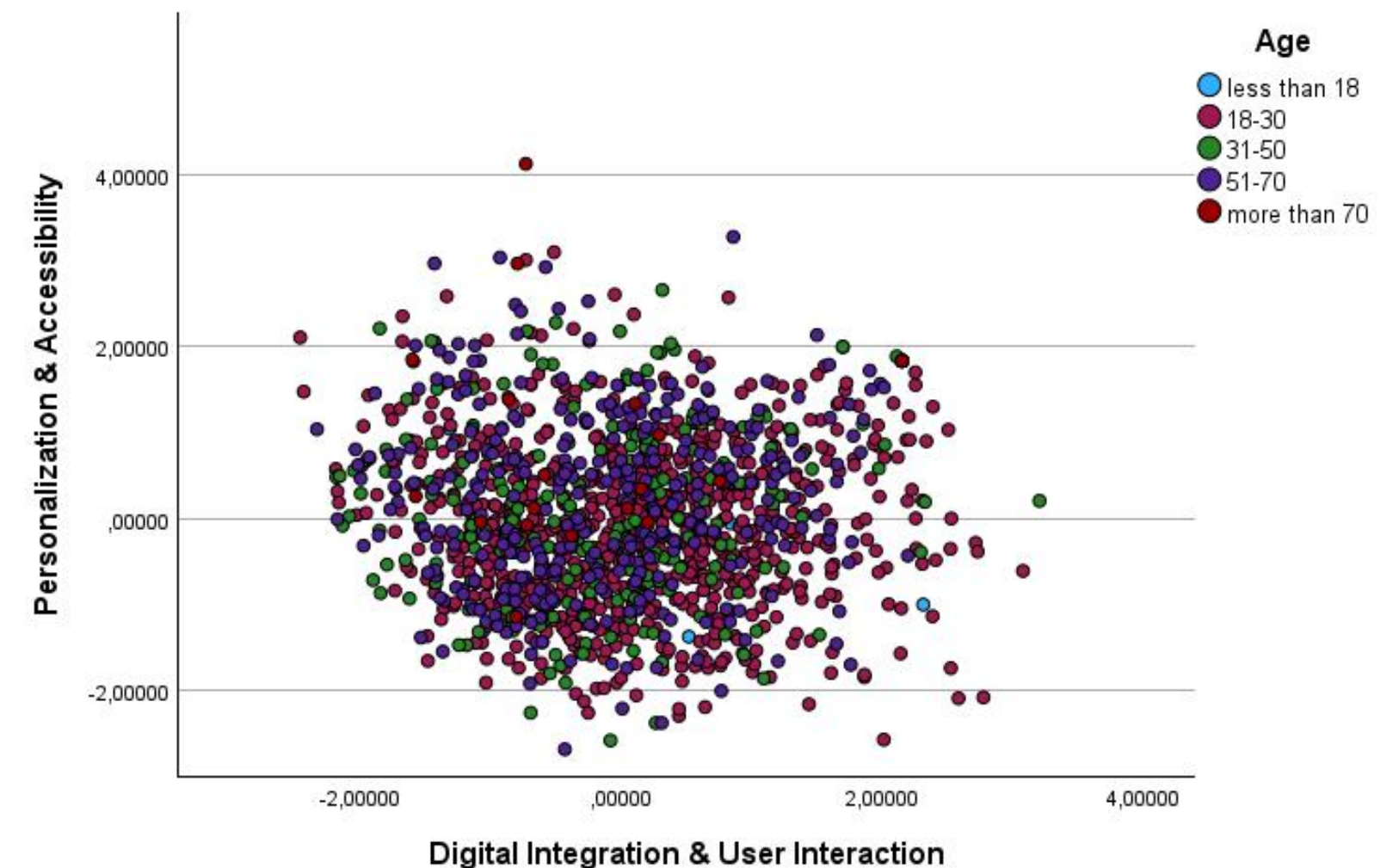
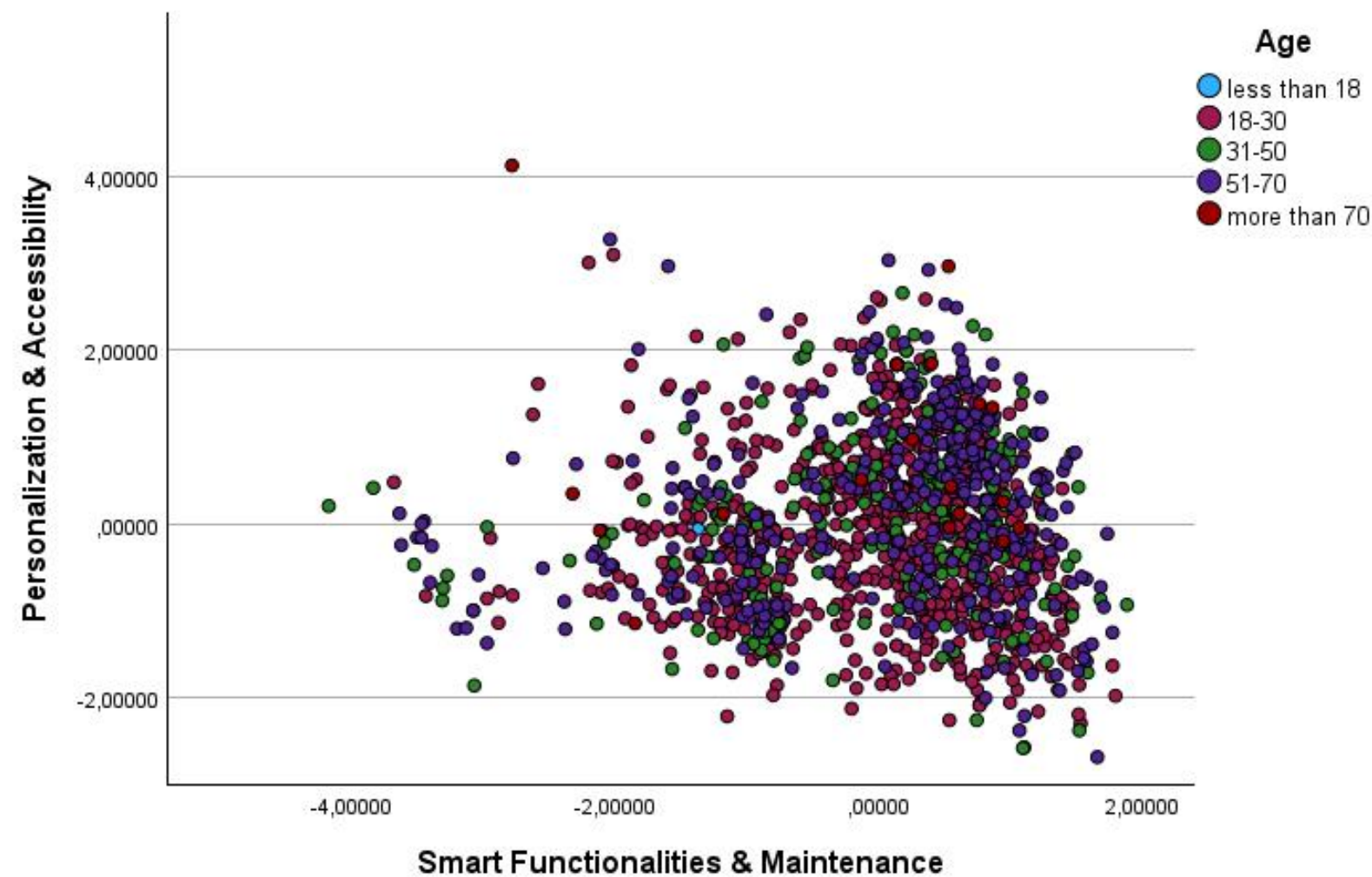


An analysis of how different sets of customers react to specific primary needs. We picked for our study age and annual net income

Considering the three largest age ranges, for each of them, there is no real correlation between Digital Integration and Maintenance

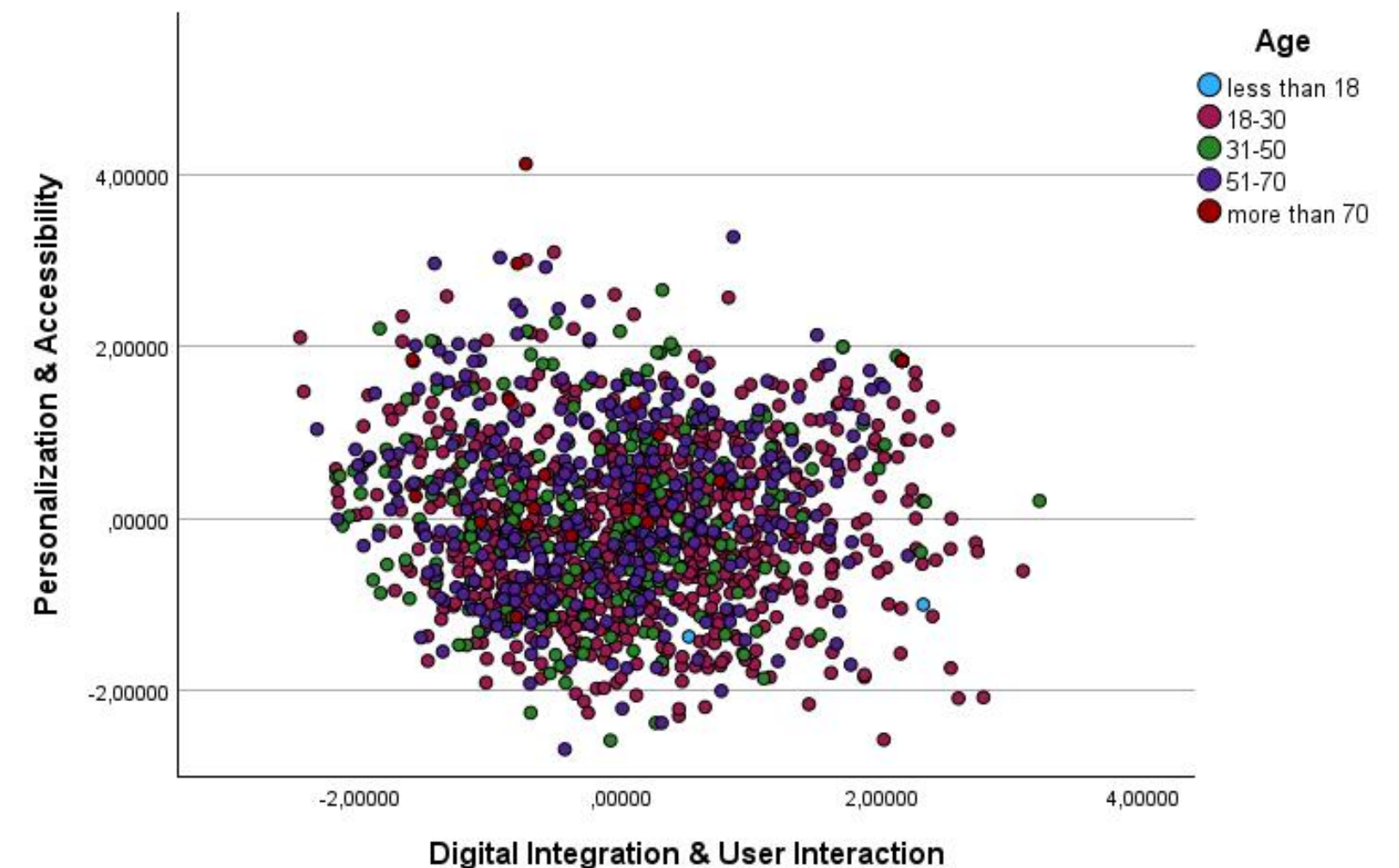
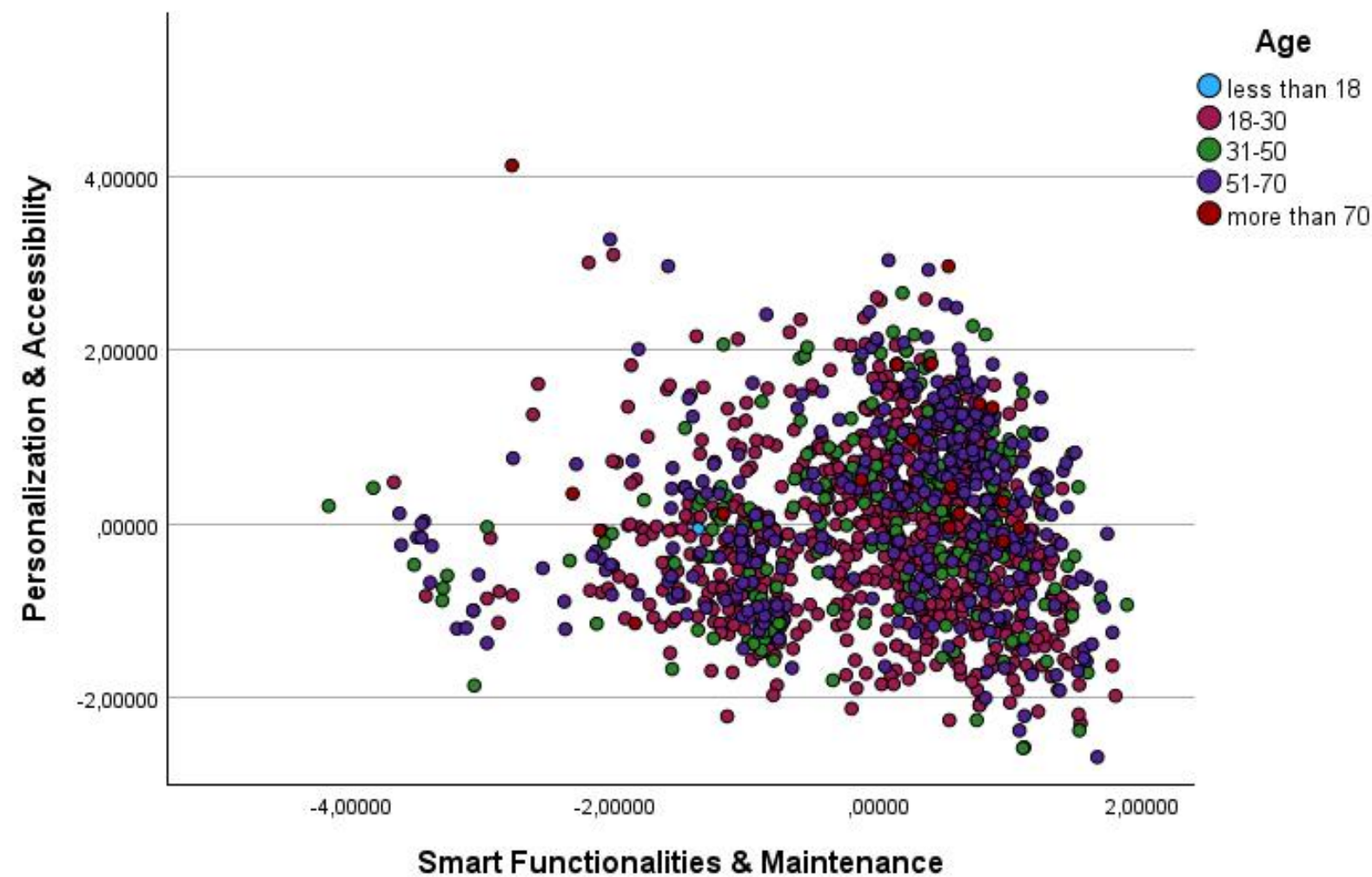
Respondents' positions in the perceptual space

The same could be observed for the other synthetic variables correlations keeping the same descriptive variable. Indeed, it seems that age difference is not a really preponderant factor when we look for requirements



Respondents' positions in the perceptual space

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Competitor analysis: Characteristics by secondary needs



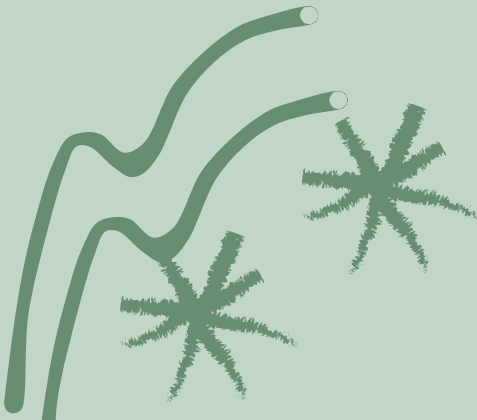
Secondary needs / Fridge	Beko BLSA210M2S	Whirlpool WTE 2511 W	Samsung RB30J3000SA
Energy Consumption (kWh/year)	215	226	272
Space (Liters)	210	252	311
Aesthetics	Modern, silver finish	Classic, white finish	Sleek, silver finish
Number of Doors	2 (fridge and freezer)	2 (fridge and freezer)	2 (fridge and freezer)
Adjustable Temperature	Yes	Yes	Yes
Shelving Units	3 glass shelves, 1 salad crisper	4 shelves, 1 salad crisper	3 glass shelves, 1 salad crisper
Noise Level (dB)	39	40	39

Same pricing category (~450-500€) .
The best choice depends on customers specific needs.

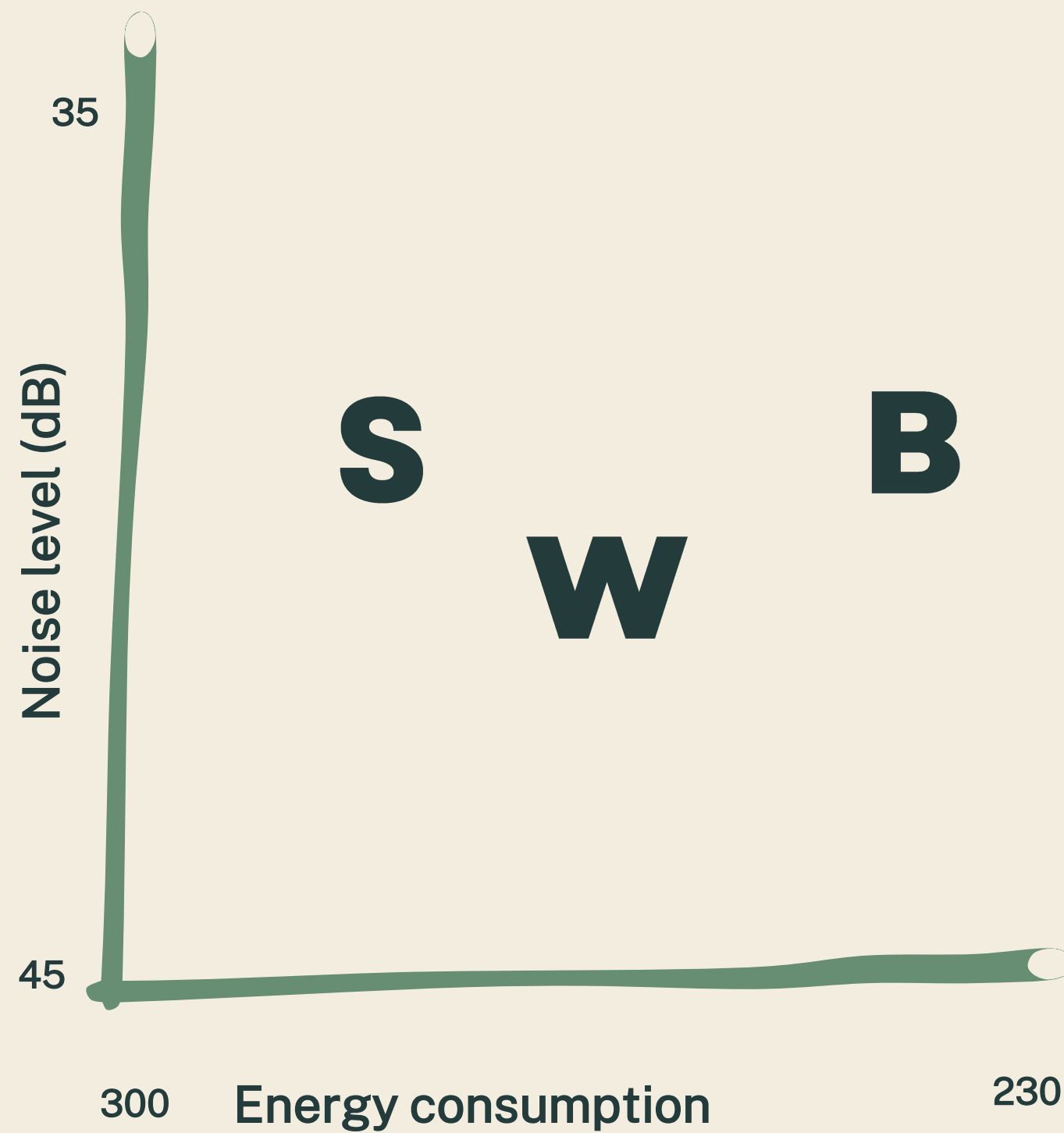
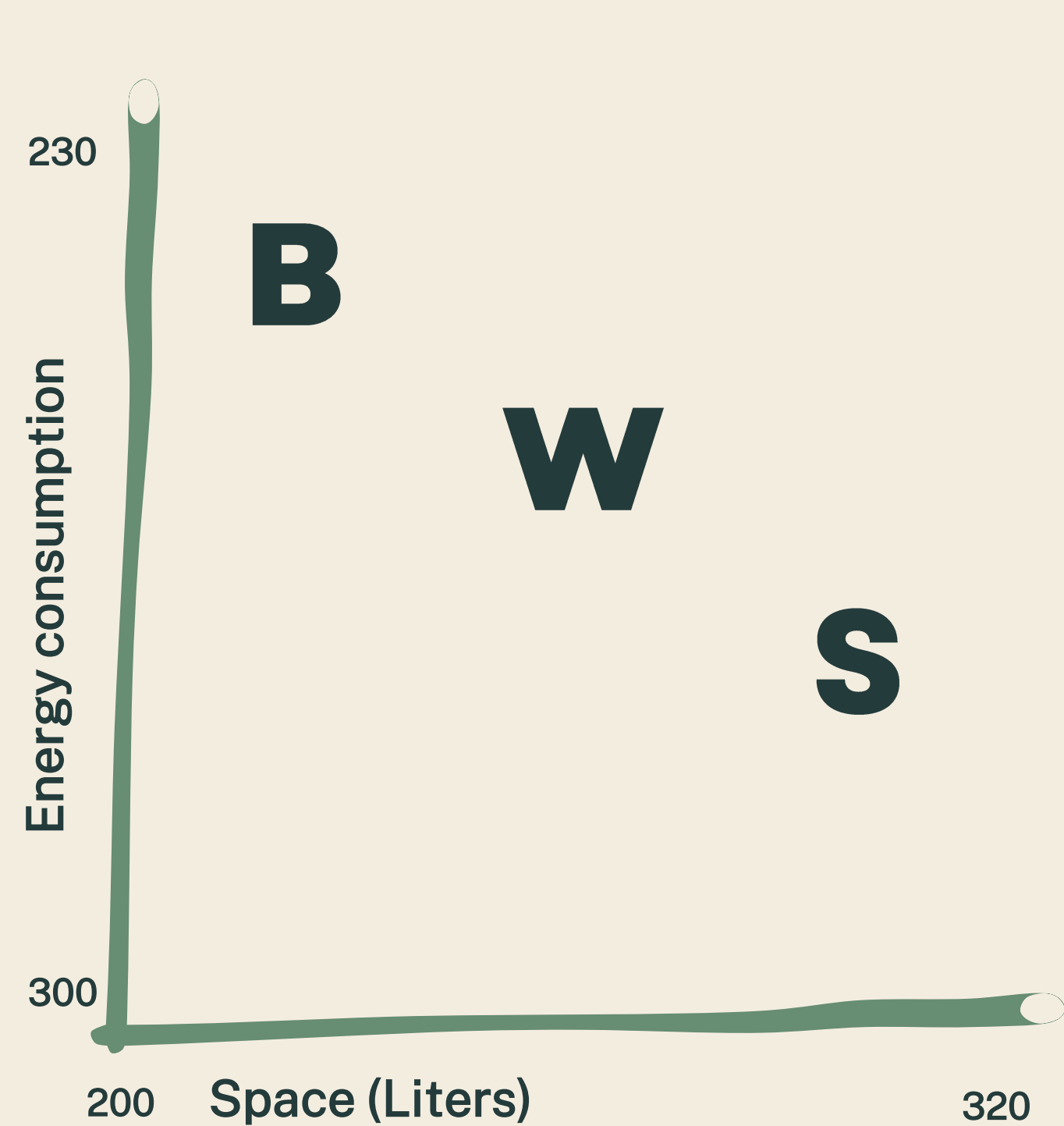
If energy efficiency is a top priority, Beko might be the best option.

If storage, Samsung offers the most space.

All three have similar features and modern aesthetics, so personal preferences and specific requirements will play a significant role in the final decision



Competitor analysis: Value maps



→
* Energy consumption
and Noise level –
the lower the value –
the better,
the scale is reversed

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